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BY  
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New York

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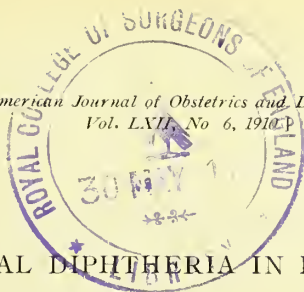
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## NASAL DIPHTHERIA IN INFANTS\*

BY

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NASAL diphtheria is not uncommon, but is often overlooked and the condition illy diagnosed. My own observations since the days of my internship at the South Department of the Boston City Hospital and down to the present time lead me to believe that nasal diphtheria in young infants is fully as common, if not more so, than is pharyngeal, but is passed off as a common cold. Were microscopical examinations made of the nasal secretion which has persisted for some time with no other observable causes, we might find the condition a more common one, as did Nemann, Schiller, and Stenger. I have verified this. The subject is not a new one. Severino mentions cases in the sixteenth century according to Anton; even back in 1748 in Normandy, France, gangrenous nasal diphtheria or a form of nasal inflammation similar to that of nasal diphtheria of the present time is recorded. Chalmer in 1771-1775 mentions conditions akin to our own knowledged nasal diphtheria which extended from the pharynx to the nose and into the Eustachian tube. Alaymus, indeed, in the seventeenth century observed similar cases in Naples and Sicily apparently of a primary and not of a secondary nature.

The cause is the Klebs-Loeffler bacillus. The predisposing factors are rachitis and malnutrition, such infants being predisposed to any inflammatory condition of the nasal mucous membrane. Bottle-fed infants, their mucous membrane lacking the vitality, the life of those of nurslings, are subject to it. Congested tenements, illy ventilated rooms, adenoids, congestion of the epipharynx, articles placed in the nose, and deflected septa aid materially in producing a fertile soil. Even in healthy nurslings any draught may cause primarily a congestion of the nasal mucous membrane followed by the implantation of the Klebs-Loeffler bacillus.

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Care must, however, be taken in ruling out those catarrhal conditions resulting from measles, influenza, pertussis, typhoid, syphilis, etc., the absolute diagnosis only being possible by a microscopical examination. Parnicko sums up the condition in these words: "The diphtheria of the nasal passages is dependent upon the disposition and constitution of the patient, to the virulence of the bacillus, and to the presence and activity of other microorganisms."

Nasal diphtheria in my experience is never absolutely of a pure character, but the simplest forms show a greater or smaller number of other bacteria. Nasal diphtheria is both primary and secondary. The condition runs through three stages: that of a catarrhal rhinitis, that of a fibrinous rhinitis, and that of a diphtheritic catarrhal rhinitis.

In the primary form nurslings as well as artificially fed infants are affected. This form may stop at the simple acute catarrhal stage and get well without involving the pharynx or the adjacent sinuses in the least. The mucous membrane is reddened, slightly puffy, the discharge is watery, usually profuse, but colorless. Of the bacilli the Klebs-Loeffler predominates.

The discharge changes to seromucus, the color to dark gray, brown, etc., bloody red or streaked with blood if streptococci, staphylococci, and the pseudobacilli are present. At times a slight cervical adenitis of the affected side is seen. If both nares are affected a moderate adenitis of the anterior cervical glands on both sides of the neck is present, which glands are considerably swollen and perhaps slightly painful. This stage is often overlooked and not treated, passing away in a few days leaving the mucous membrane sound as before infection. The fever is rarely high, the prostration never marked, the infant rarely very much indisposed.

The primary form, particularly in the first stage, in my experience does not tend to involve the pharynx unless the infant is malnurtured, has adenoids, a malformed nose, a deviated septum, or the like. The primary form may pass from the initial stage to the second or fibrinous; likewise the extension of the process from the pharynx to the nose may cause the secondary form also to develop into the same stage.

The fever is low, in fact characteristic of true diphtheria, never over 100.5° F.; prostration is often marked. Both nares, or less commonly, one are swollen, the mucous membrane is thick, gray, grayish-white, at times tinged with yellow or streaked with

blood. A characteristic diagnostic and diphtheritic fetid sweet odor is experienced rather oftener during the first stage. If a piece of the membrane is pried off through sneezing or from picking the nose, the base is seen to be bloody, excoriated, hyperemic, or glassy. A new membrane or thin crust in its place is seen the next day. In eight to ten days the membrane disappears, if untreated, before if treated, leaving a moderate diphtheritic catarrh or the third stage of the disease. The fever now has subsided if no digestive symptoms are present, while the constitutional symptoms are lessening, but the sneezing which occurs during the first two stages still persists. This latter catarrhal condition may last for weeks. Later Frankel's bacillus, the pneumococcus, the pseudodiphtheritic and the staphylo- or streptococcus may implant themselves upon this fertile soil.

The clinical appearance of a case as seen in the second stage is one not easily overlooked. The nose is moderately puffy, soggy, flattened, often partially or totally occluded, the mouth open, the infant gasps for air, and there is often marked dyspnea. The membrane may be seen protruding while a thin colorless or bloody catarrhal secretion bathes it. Excoriations are seen under the nares and around and above the upper lip. Such a condition interferes with nursing, bottle-feeding, sleeping, nose breathing, and resting. The infant meanwhile grows weaker and weaker and finally dies of asphyxia.

The persistency of the third or the diphtheritic catarrhal stage is undoubtedly due to the implantation of the bacillus in the accessory sinuses of the nose. Councilman, Mallory, and Pierce, according to Holt, have shown that it is common for the accessory sinuses of the nose, particularly the antrum of Highmore, to be involved, and the closing of the Eustachian tube from the extension of the process may also take place. The infection may extend also through the lachrymal duct, closing it and causing the eyes to overflow with tears which flow down over the face. The frontal sinus likewise may be involved. The Klebs-Loeffler bacillus is at all times tenacious of life and can easily live for a long time on friendly mucous membranes.

In infants the cervical adenitis of any stage rarely terminates in sloughing or abscess. I remember one case in the Boston City Hospital where putrefying bacteria implanted themselves upon a fibrinous rhinitis giving rise to a markedly putrefactive condition dirty brown in color and streaked with yellow, while

over it blood flowed down the face. The smell in such cases is overpowering.

The above classification as to the three stages of nasal diphtheria I believe to be the best one. On the other hand, some authors, as Frankel, Hoffman, and Beck, think that the second stage, fibrinous rhinitis, is an independent disease, as few Klebs-Loeffler bacilli are apparently found and these due to their implantation on the surrounding membranes. Baginsky, however, considers fibrinous rhinitis diphtheritic unless bacterial examination proves otherwise. Bretonneau sums up his idea of the diagnosis of nasal diphtheria when he says that one or two enlarged glands combined with redness of the upper lip on the same side as are the pathological lesions, are pathognomonic symptoms.

The nasal type of diphtheria may be remarkably contagious. Often the most virulent forms of bacteria are found where only moderate lesions are present as seen in the first stage and in the last stage of the disease. The contagiousness, the easy transmission of the secretion from the nasal passages of the patient to the susceptible mucous membranes of the recipient as in caressing, kissing, etc., the long life of the bacillus and its capability of causing an epidemic after the acute symptoms in the subject have long subsided, render the danger a very acute one. Park in 1892 was able to demonstrate four months after removal the presence of living diphtheria bacilli in a bit of membrane no larger than a pin's head.

The first form, that of simple catarrhal rhinitis, is, in my experience, the most virulent, the fibrinous form the next, and the diphtheritic catarrhal form the least. The bacillus is conveyed indirectly on articles of clothing, linen, brushes, handkerchiefs, shoes, food, dust, milk, and in innumerable other ways.

The prophylaxis of the patient and of his surroundings is almost as necessary as is the treatment; conscientiously done it means no further contagion. A suitable room should be chosen facing south if possible, sunlit, having proper ventilation but no draughts, and capable of an average temperature of 70° to 75° F. Plates, bottles, nipples, spoons should be sterilized; napkins to receive the nasal discharges, of Japanese paper preferably, should be burned before taken from the sick room. The room itself should be free from as much furniture as possible and that present should be capable of being cleaned. It should be aired daily. Cheap toys need not be withheld and can be



destroyed after convalescence. When the infant is well this room should be rendered livable by fumigating with formaldehyde candles before use, leaving all the articles used during the illness in the room, including the blankets, rugs, and the clothes of the attendant. The room should be sealed tightly for forty-eight hours after the formaldehyde treatment. The attendant before entering the room during the illness should wear a suitable cap and gown and come in contact with the patient as little as possible, and if possible only with the hands. An immunizing dose of antitoxin should be given to each member of the family, 500 to 2000 units, as the ages warrant, subcutaneously or by the mouth, and they must not mingle with others. A solution of corrosive sublimate 1-5000 should stand in a porcelain bowl before the door of the sick room and persons leaving that room must sterilize their hands.

Swab cultures from the nose ought to be taken every three days until no bacilli are found to be present, care to be used in pushing the swab gently toward the posterior nares. I often find positive cultures weeks after an observable cure.

The general treatment of the infant is simple. Do little but do that little well is a good motto. During the first or catarrhal stage the infant suffers little from prostration, malaise, or loss of appetite. A nursling should have its regular feedings from the mother, the latter protecting the nipple by cleanliness immediately after nursing. She, moreover, should receive a larger immunizing dose of antitoxin than does the rest of the family. A bottle baby should have its modification of milk at regular intervals as before. If the modification is not taken well it is best to weaken the proteids. During the summer months the infant can be kept on the fire escape or sheltered on the roof. During the intervals between feedings I give  $\bar{5}i$  to  $\bar{5}iii$  of fruit soups or raw pineapple or orange juices, warm, uncooked and slightly sweetened.

Do not use nasal douches. The infant should be bathed two or three times a day, sponged in water at 85° to 105° F. Pledgets of absorbent cotton moistened in carbolic acid 2 per cent. and inserted alternately in both nares afford great relief.

In the fibrinous form food is often not relished owing to the systemic infection, occluded nares, and the loss of strength. It may be at times best to take away the modification or the breastfeeding for a short time and give peptonized milk or wine whey, using  $\bar{5}ss$  of old sherry wine to a cupful of milk or adding  $\bar{5}i$

to 3iii of this wine whey to a reduced modification of milk; while bathing the patient in warm water three or four times a day is very necessary. For the prostration strychnine gr.  $\frac{1}{200}$  to  $\frac{1}{150}$  by the mouth or subcutaneously, preferably by the former, is efficient. Caffeine in my hands, gr.  $\frac{1}{20}$  to gr.  $\frac{1}{4}$ , two to three times daily has acted well. Camphor is also useful as the spiritus camphoræ in 5 to 10 m doses.

Broths, bouillons, peptonized milk are at times needful. Castor oil in small but frequent doses relieves the constipation. Fruit juices, such as pineapple and orange, raw but warm, and fruit soups, warm, can be given from the first between feeding; they act as a laxative diuretic and as a mild tonic.

These soups are made by boiling fresh or dried fruits for many hours in water plus sugar, pressing and straining through two layers of clean muslin cloth, thirty-one to thirty-four can be given one, two, or more times daily. These cooked fruit juices contain albuminates, carbohydrates and organic acids in the same proportion as found in the raw juices, yet the latter possess the tang, the volatile elements, the life, which are so stimulating and refreshing.

Pledgets of raw warm pineapple juice soften and probably partially digest the crusts and can be followed with pledgets of cotton containing carbolic acid 2 per cent. or warm sweet oil, hydrogen peroxide  $\frac{1}{4}$  strength, or warm argyrol 5 per cent. Wet cold cloths over the inflamed nose sometimes relieve. Nasal douches push the infected membrane into the nasal pharynx, causing further infection of the surrounding sinuses and are therefore contraindicated.

The third stage should be treated by conditions governing a healthy infant. That means proper food, bathing, and fresh air, and a normal salt solution two or three times daily, warm, should be allowed to flow under no tension through the anterior nares and into the pharynx. The fruit juices should be continued as desired by the little patient.

The use of Behring's serum or antitoxin in all forms of diphtheria is most important. Since my internship great changes have taken place in its preparation. It is now more concentrated and void of certain irritating qualities the first used serum possessed making at that time the cure worse often than the disease itself, as was seen in the distressing urticarias and digestive conditions resulting. Enough serum should be given to our little patients to neutralize the poison and therefore the dose is de-



pendent upon the age of the patient, the severity of the intoxication and the extent of the nasal membrane. Therefore it is well never to wait for a pathological examination in a suspected case, but to give the serum immediately. In the initial stage of the disease little antitoxin is needed. Fifteen hundred units injected deeply into the buttock with a subcutaneous syringe and needle, which can be rendered aseptic, once, and followed by 2000 units by the mouth, given at the midway point between feedings for once or twice at intervals of six hours, is usually enough.

The intense intoxication affecting the heart, liver, kidneys, and the postdiphtherial paralyses I have never seen after the primary form or after the first stage, but following the second and third stages. More or less albumin is present in the urine in all stages. In the second stage I followed up the original injection by another five hours later, or, again, perhaps a third deeply injected into the buttock. As the membrane disappears 2000 units are again given by the mouth once, twice, or three times as the case may warrant. Study of the condition of the membrane and of the intoxication at each visit should be of paramount importance. In my hands this mouth method has worked well for years. Escherich of Vienna has tied the serum by mouth and rectum and has got good results from the former method. Salge experimented by giving antitoxin in milk. None was found in the blood. He therefore concluded that the homologous proteids of the serum of the horse could not pass through the walls of the alimentary canal. Uffenheimer, however, found different results. Pick, in an experiment lasting nine days, showed that two-thirds of the antitoxin given by mouth was destroyed during the trypsin digestion and he believes that the intestinal bacteria exert harm upon the antitoxin. It is possible he says further that the homologous or heterologous nature of the antitoxic serum may influence absorption.

Primary nasal diphtheria tends to remain primary unless malnutrition adenoids or malformation of the nasal septum be present. Antitoxin is not infallible. Most physicians think that Behring's serum given early prevents postdiphtheritic paralysis, or the intense degeneration of the different organs. Unfortunately some cases are governed by no direct rule and paralyses appear in spite of the serum and resist treatment. Clapies offers a plausible explanation for this. He considers that two kinds of diphtheritic paralysis exist, the one cured by serum, being due

to soluble toxins produced by the Klebs-Loeffler bacillus, the other resisting the serum, arising from endotoxins or poisons produced by the bacterial bodies themselves. Rist proved by experiments the reality of paralyses brought about by these products in animals which behave like the obstinate paralyses in man, and raises the hope that a combination of an antiendotoxic with the antidiphtheritic serum may eventually absolutely prevent these paralyses whatever may be their pathogeny.

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